The attached Appendix includes a marked-up copy of the rewritten claim (37 C.F.R. §1.121(c)(1)(ii)).

Entry of the amendments is proper under 37 CFR §1.116 since the amendments: (a) place the application in condition for allowance for the reasons discussed herein; (b) do not raise any new issue requiring further search and/or consideration since the amendments amplify issues previously discussed throughout prosecution; (c) do not present any additional claims without canceling a corresponding number of finally rejected claims; and (d) place the application in better form for appeal, should an appeal be necessary. The amendments are necessary and were not earlier presented because they are made in response to arguments raised in the final rejection. Entry of the amendments is thus respectfully requested.

Specifically, claim 1 is merely amended to include the features of dependent claim 3, which has been canceled. Thus, the amendments to claim 1 cannot raise new issues.

I. The Claims Define Allowable Subject Matter

The Office Action rejects claims 1 and 2 under 35 U.S.C. §102 as unpatentable over Europe (598) or Japan (360); claims 1 and 2 under 35 U.S.C. §103 as unpatentable over Japan (360) or Europe (598); and claims 3 and 4 under 35 U.S.C. §103 as unpatentable over U.S. Patent No. 5,448,126 to Eda et al. (hereinafter "Eda") or U.S. Patent No. 6,018,211 to Kanaboshi et al. (hereinafter "Kanaboshi"). The rejections are respectfully traversed.

Since the features of claim 3 are added to independent claim 1, it is respectfully submitted that the rejections of claims 1 and 2 are therefore obviated. Further, claim 4 is canceled. Thus, only the rejection of claim 3 is substantively traversed below.

Claim 1 recites a piezoelectric oxide single crystal wafer wherein metal electrodes having a width of 1 μm or less are to be formed on a surface of the wafer, and a number of particles adhering to the surface of the wafer and having a size of 1 μm or more is 85 or less per mm^2.

Contrarily, Eda discloses a surface acoustic wave device using a piezoelectric single crystal plate consisting of quartz crystal, lithium niobate, lithium tantalate, or the like. At

col. 7, lines 4-7, Eda discloses that surfaces of the plate are cleaned sufficiently, and at col. 6, lines 21-26, and col. 9, lines 46-53, for example, that inter digital transducers (IDT) 3 and 3' and an output electrode 4 are provided on the piezoelectric plate 2, as shown in Fig. 3.

Also, Kanaboshi discloses a surface acoustic wave device using a piezoelectric single crystal plate consisting of quartz crystal lithium niobate, lithium tantalate, or the like. At col. 9, lines 33-34 and lines 58-59, and col. 10, lines 18-19, Kanaboshi discloses that surfaces of the plate consisting of quartz crystal or the like to be used is cleaned sufficiently, and at col. 7, lines 26-35, Kanaboshi discloses that a lead electrode 12 and an inter digital transducer (IDT) 14 are formed on a quartz crystal substrate 11, as shown in Fig. 1(a).

At paragraph 3, page 2, of the Office Action, the Examiner asserts that, although Eda and Kanaboshi each disclose that none of specific degree of cleaning and the electrode finger widths are explicitly stated, providing suitable electrodes for any specific desired operating frequency would be within the skill expected of one in the art, and that the amount of cleaning would be a difference in degree rather than a difference in kind. Thus, the Examiner concludes that selection of specific degree of cleaning would have been obvious to one of ordinary skill in the art.

This assertion is respectfully traversed. Eda and Kanaboshi each only discloses that the surfaces are cleaned and the electrodes are formed thereon. Neither of these references refer to a relationship between particles adhering to the surfaces and widths of electrodes, much less a number of particles adhering to the surface of the wafer and having a size of 1 μm or more of 85 or less per mm^2. Inherently, Eda and Kanaboshi each only discloses that an LT (lithium tantalate) substrate or the like is cleaned before the substrate is bonded to a semiconductor substrate or the like.

In Eda, as discussed in its Field of the Invention and drawings, a piezoelectric plate, such as an LT substrate or the like, is bonded to a semiconductor plate. As disclosed at col. 4, line 31, of Eda, the semiconductor plate is bonded directly to the piezoelectric plate by hydrogen bonds or by covalent or ionic bonds. Thus, as disclosed at col. 4, lines 37-40,

preferably, the thickness of a direct bonding layer at an interface between the piezoelectric and semiconductor plates is 20 nm or less. It is easily estimated that in order to realize the thickness of the bond layer of 20 nm or less, foreign materials must be eliminated from the bond layer. Accordingly, as disclosed at col. 7, line 4, the surfaces must be cleaned sufficiently. Also, in the direct bonding, as disclosed at col. 7, lines 8-11, after the two surfaces are subjected to hydrophilic treatment, they are rinsed with pure water.

The same applies to Kanaboshi. Kanaboshi, as disclosed at col. 2, lines 14-16, relates to a surface acoustic wave element with a lid, and in each of its examples, the surfaces of its substrate and lid are cleaned as pointed out by the Examiner. However, this cleaning is performed to directly bond them to each other in a subsequent process.

Contrarily, the claimed invention relates to a piezoelectric substrate itself, and not to direct bonding to another substrate, etc. The claimed invention defines the number and size of particles which relate to characteristics of a surface acoustic wave element, and not to direct bonding as in Eda and Kanaboshi.

Modifying Eda and Kanaboshi to result in the claimed invention would not be possible to one of ordinary skill in the art. As pointed out by the Examiner, for a SAW device, it might be obvious that one would not want loose debris, and as disclosed at page 3, lines 17-21, of the present specification, "it is considered desirable that particles adhered to wafer surfaces should be made few as much as possible". However, as disclosed at page 2, line 22, to page 3, line 17, of the present specification, there is a problem that in piezoelectric oxide single crystal wafers manufactured by conventional methods as those for surface acoustic wave filters, many particles remain on wafer surfaces, and therefore, if the device, especially as for the recent device having each width of metal electrodes of 1 μm or less, is manufactured, there is a problem that the device yield will be degraded. Accordingly, as disclosed at page 4, lines 12-27 of the present specification:

> "the inventors of the present invention found that, in a piezoelectric oxide single crystal wafer after cleaning, there was a correlation between the number of particles adhering to the wafer surface and the yield obtained in the element fabrication utilizing the wafer. Then, they assiduously studied in order to achieve the aforementioned object, and as a result, they found that, if a piezoelectric oxide single crystal wafer had particles adhering to a surface of the wafer and having a size of 1 μm or more in a number of 85 or less per mm^2, it satisfactorily allowed fine electrode formation in the element fabrication process and hence enabled device production with good yield. Thus, they accomplished the present invention."

Further, as disclosed at page 4, line 27 to page 5, line 9, and shown in Fig. 1 of the present application, if a piezoelectric oxide single crystal wafer of which number of particles, adhering to a surface and having a size of 1 μm or more is 85 or less per mm^2 is used, devices can be produced with a high yield of at least 50% or more.

Thus, the inventors of the present invention assiduously studied, and as a result, they found that, there was a correlation between the number of particles adhering to the wafer surface and the yield obtained in the element fabrication utilizing the wafer, as shown in Fig. 1, and further found that if a piezoelectric oxide single crystal wafer, on which electrodes having a width of 1 μm or less are to be formed, has particles in the number of 85 or less per mm^2, adhering to a surface of the wafer and having a size of 1 μm or more, this allows device production with good yield. These findings cannot be obtained via routine trial and cost analysis consideration as asserted by the Examiner. The Examiner may argue that the surface on which electrodes are to be formed is cleaned as much as possible via routine trial and cost analysis considerations. However, concerning the claimed piezoelectric oxide single crystal wafer on which electrodes having a width of 1 μm or less are to be formed, the number of particles adhering to a surface of the wafer and having a size of 1 μm or more is 85 or less per mm^2 could not be discovered by one of ordinary skill in the art upon reviewing Eda and Kanaboshi.

For at least these reasons, it is respectfully submitted that claim 1 is distinguishable over the applied art. Claim 2, which depends from claim 1, is likewise distinguishable over

the applied art for at least the reasons discussed as well as for the additional features they recite. Withdrawal of the rejections under 35 U.S.C. §§102 and 103 is respectfully requested.

II. Conclusion

For at least the reasons discussed above, it is respectfully submitted that this application is in condition for allowance.

Should the Examiner believe that anything further is desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact Applicants' undersigned representative at the telephone number listed below.

Respectfully submitted,

William P. Berridge
Registration No. 30,024

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WPB:EDM/gam

Attachments:
Appendix
Petition for Extension of Time

Date: October 8, 2002

OLIFF & BERRIDGE, PLC
P.O. Box 19928
Alexandria, Virginia 22320
Telephone: (703) 836-6400

DEPOSIT ACCOUNT USE AUTHORIZATION
Please grant any extension necessary for entry;
Charge any fee due to our Deposit Account No. 15-0461

APPENDIX

Changes to Claims:

Claims 3 and 4 are canceled.

The following is a marked-up version of the amended claim:

1. (Amended) A piezoelectric oxide single crystal wafer, wherein metal electrodes having a width of 1 μm or less are to be formed on a surface of the wafer, and a number of particles adhering to ~~a~~ the surface of the wafer and having a size of 1 μm or more is 85 or less per mm^2.